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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/070,908	05/04/98	SAKAMA M	0756-1799

IM62/0629

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EXAMINER	
PADGETT, M	
ART UNIT	**PAPER NUMBER**
1762	14

DATE MAILED: 06/29/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/070,908	Sakama
Examiner	**Group Art Unit**
M.L. Padgett	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 3/7/00.

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 23-29 + 31-103 is/are pending in the application.

Of the above claim(s)_____ is/are withdrawn from consideration.

☐ Claim(s)_____ is/are allowed.

☒ Claim(s) 23-29 + 31-103 is/are rejected.

☐ Claim(s)_____ is/are objected to.

☐ Claim(s)_____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on_____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on_____ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number)_____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received:_____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s)._____

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other_____

Office Action Summary

(1) Claims 23-103 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 23-29, the claim of "a total amount" is vague and indefinite because it is unclear what quantity is used to determine that total. Since all reactive gases, especially Si-containing ones, are not ideal gases (and neither is H_2), having the same number of molecules total at all times would be different than maintaining the same total pressure, ie constant pressure. As both p. 19, lines 17-19 of the specification and p. 18 of applicant's remarks of the 3/9/2000 amendment discuss constant pressure, applicant may consider using such wording or -- -- total pressure-- instead of the vague "total amount".

Claims 51-57 are vague and indefinite as it is unclear what they are suppose to encompose that is not already covered in the independent claims, as wording such as "discontinued with a start of..." is not seen to have any significantly different meaning from "discontinued simultaneously with a start of". Furthermore, in the dependent claims "a supply" or "a start" use wrong articles for previously introduced terms.

Claims 51- 57 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. For reasons stated above.

New claims 58, 64, 70, 76, 82, 87, 92 and 98 have preambles that are not commensurate in scope with the claimed steps, especially the most generic claimed ones that never deposit any particular material.

In claim 64, line 8 "said hydrogen gas" has absolutely no antecedent basis. Note analogous problems in claims 76, 87 and 98.

In claim 92, applicant has claimed that both the α-Si semiconductor layer and the insulating gate layer are deposited by the same step and some reactive gas. It is unclear how one step produces two separate layers. Claim 98 has analogous problems.

Claims 92-103 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. No clear support for this one step deposit of two layers was found, especially with just the one discharge treatment either before both or after both deposited layers.

(3) Claims 24-29 and 31-103 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant's claims remain replete with new matter and the apparent contention that since α-Si is taught (i.e., films containing only amorphous Si) that applicants are entitled to any

amorphous film as long as it contains some Si is not convincing. No support for neither "amorphous film comprising silicon" or "a semiconductor film comprising amorphous silicon" was found. Simply reordering the words doesn't change the meaning nor fix the problem. There are statements such as p. 1, line 5 directed to generic thin film deposition, however, no silicon or carbon films that may contain significant other constituents, i.e. are "comprising" Si or C, were found. Reference to amorphous silicon films is found throughout the specification, with page 7 also mentioning microcrystalline Si or crystalline silicon, but no support for "...comprising..." which is open language. The addition of semiconductor does narrow the possible meanings, but does not eliminate the unsupported breath, so these broader than disclosed limitations are New Matter.

In the claims where applicant's use of RF energy ambiguously, it is not necessarily clear that they require the film deposition to be caused by plasma or RF discharge, as use of RF energy does NOT necessitate that any plasma formation or discharge actually takes place unless the antecedent basis is clear, since radio frequency energy may be used to power heaters, etc. The specification, specifically, from the first sentence to the end requires that the claimed deposition be via RF plasma discharge, hence this ambiguous broadening of scope might also be New Matter.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

(5) Claims 23, 25-29, 45, 47, 48, 50-51, 53-57, 70-82, 84-87 and 89-103 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. Kozuka teaches deposition of multiple layer non-monocrystalline semiconductor devices, exemplified by deposition of amorphous silicon TFT (thin film transistors), by forming successive layers in a manner such that a plasma atmosphere is constantly maintained from the start until the end of the film formation process, in order to protect the interfaces from damage by initial stages of plasma formation and from contamination (Abstract), as typically found in discontinuous plasma processes (col. 2, line 57-col. 3, line 7). In col. 4, lines 38-49, Kozuka particularly teach that "since the plasma is continuously generated, the start and end of film formation can be achieved by changing the raw material gas. During film formation, therefore, the raw material gas is preferably used, not singly but as a mixture with a diluting gas [exemplified by H_2, which differs from the present claims]. With the use of such mixed gas, when the supply of the raw material gas is terminated after the completion of film formation, the discharge is maintained by the diluting gas so that the fluctuation in plasma can be suppressed." Also Embodiment 1 (col. 5, lines 57-68+) indicates a process of keeping the pressure the same for the deposition and H-plasmas. "The diluting gas can be hydrogen, argon or helium..."(col 4).

Embodiments 2 (col. 6, line 55- col. 9, line 12) and 3 (col. 9, line 15-col. 10, line 22), form plasma deposited amorphous Si TFT films using silane gas and H_2 as a dilutant, with the first deposition being a plasma deposited Si_3N_4 insulating film, followed by films that read on claimed deposits. Reactant gas (SiH_4) flow is stopped in each plasma chamber and the dilutant gas plasma continues in that chamber before transfer to the next chamber, where the dilutant gas plasma is present before reactive gas starts to flow into the chamber.

Kozuka differs from applicant's claims by using H_2 dilutant gas during both deposition and non-deposition plasmas in their examples, and by stating a preference for the dilutant gas (H_2 or Ar or He) to be mixed with the reactant gas, while applicant's only use hydrogen gas or "discharge gas" (equivalent to Kozuka's dilutant gas) during their non-deposition plasma, either before or after the amorphous silicon containing deposition. From col. 4, lines 50-62, it appears that the main reason the dilutant gas is used with the reactant gas is so that only one gas flow needs to be turned off and thus avoid problems if one's flow control equipment has slow response. However, as is seen by the teachings of Gupta et al. (Abstract; col. 2, lines 50-54; col. 3, lines 16-38; col. 5, lines 30-50; col. 6, line 61-col. 7, lines 20 and 35-40; and claims 9-11, especially col. 5, lines 39-42) that for an inert plasma gas, such as Ar, used for pre- or post-processing (deposition) plasma that prevents particle contamination of the substrate, that the inert gas maybe stop simultaneous with start of the reactant gas, such that constant plasma is maintained and particle contamination prevented. While Gupta does not discuss the pressure used, constant plasma is consistent with constant pressure. Given the teachings of Gupta et al.

which are taught to be generally applicable to plasma processes, including depositions and processes exemplified by using silicon containing gases such as TEOS, it would have been obvious to one of ordinary skill in the art, that the dilutant gas of Kozuka (H_2 or Ar or He) need not have been mixed with the reactant gas, because it is not needed for the chemical reaction involved in the deposition, and Gupta et al. shows that is possible to achieve the objective of Kozuka (preventing contamination and achieving a full plasma before introducing reactant gas, i.e., equivalent to no plasma on/off hysteresis) via switching from inert gas to reactant gas, instead of maintaining the inert or dilutant gas flow throughout the sequence. Kozuka's teaching of using the same pressure would apply equally regardless of when dilutant gases used in order to maintain plasma and particle control. Obviously, if ones equipment has poor gas flow timing control, one would not use the modification form Gupta et al., but where sufficient regulation abilities exist, ~~one would have been further sufficient regulation abilities exist~~, one would have been further motivated by saving resources from wasteful or unneed use.

The timings for length of non-coating plasmas will depend on mechanical and electrical abilities of the systems, and be determined by routine experimentation by the competent practitioner. Note Kozuka discusses TFT devices in general and the presence of a gate electrode on the substrate before deposition of Si_3N_4 and ~~a~~-Si layers on col. 7, lines 45-55.

(6) Claims 24, 46, 52, 58-69, 83, 88 and 92-103 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. alone as applied above, or further in view of Mei, or Kaschmitter et al, or Yamuzaki et al.

Kozuka teaches initial plasma deposition of an insulating layer of silicon nitride in embodiments 2 and as mentioned above, and generally discusses the important of the interface between amorphous Si and the insulating film (col. 3, lines 8-28), but does not specifically discuss silicon oxide as the insulating film, however as SiO_2 and Si_3N_4 are conventionally used as equivalent alternative dielectrics in semiconductor devices, it would have been obvious to one of ordinary skill in the art to substitute one for the other in the teachings of Kozuka.

Alternately, any of the optional tertiary references show the use of silicon oxide layers as claimed. In Kaschmitter et al., see claims 20, 22 and 24; col. 4, line 49-col. 5, line 10 and col. 7, lines 25-27. In Yamuzaki et al. see Abstract, col. 20, lines 15-49, especially 35-39 where silicon oxide and silicon nitride are taught to be equivalently used, and claims 1, 5, 7, 9 and 14. In Mei et al., see Abstract; col. 1, lines 44-49; col. 2, lines 33-66, especially lines 58-60; col. 3, lines 1-6, where SiO_2 is seen to be used before a-Si deposits in TFT device manufacture. Hence, use of silicon oxides as claimed, would have been an obvious alternative to Kozuka's taught silicon nitride as it has been shown to be a known equivalent alternative thereto in analogous processes and structures.

(7) Claims 31-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. as applied to claims 23-39, 45-51, 53-57, 70-82, 84-87 and 89-103 above, and further in view of Mei et al., or Kaschmitter et al., or Yamuzaki et al.

These claims differ from the combination to Kozuka and Gupta et al in requiring that the amorphous Si containing film be crystallized using laser light, however the references of Mei et

al, Kaschmitter et al. and Yamuzaki et al. already introduced above, show that it is old and well known to use lasers to induce crystallization in α-Si layers in TFT structures (Abstracts, previously cited sections, plus), hence it would have been obvious to one of ordinary skill in the art to further treat the structures produced in Kozuka (as combined with Gupta et al.) as shown in any of these ternary references, because these conventional laser annealing technique are shown to be desirable for TFT devices.

(8) Czubatyj et al. were cited as equivalent to Mei et al, Kaschmitter et al, and Yamuzaki et al for laser crystallization of α-Si in TFT devices, and for teachings of interest on the alternative use of $Si0_2$ or Si_3N_4 deposited by PECVD for gate insulators used in those devices.

(10) Applicant's arguments filed 3/09/2000 and discussed above have been fully considered but they are not persuasive. It is noted that the new independent claims correspond closely to the old ones before amended, except with intended use specified by the preamble, while the old independent claims have been modified to probably mean use of constant pressure, but that is an option also taught by Kozuka.

(11) Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

(12) Any inquiry concerning this communication should be directed to M. L. Padgett at telephone number (703) 308-2336 and FAX # (703) 305-3599 (after final) and 305-6078 (unofficial).

M. L. Padgett/vr

06-22-00

MARIANNE PADGETT
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